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Habboush

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(54) **DEBRIS COLLECTING APPARATUS AND METHODS OF MAKING AND USING THE SAME**

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Related U.S. Application Data

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(51) **Int. Cl.**
A47L 9/06 (2006.01)

(52) **U.S. Cl.**
USPC **15/401**; 15/415.1; 15/344; 15/236.01

(58) **Field of Classification Search**
USPC 15/401, 415.1, 322, 344, 327.5, 236.01, 15/410, 402, 399, 400
See application file for complete search history.

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(57) **ABSTRACT**

A system and method are disclosed for a suction nozzle for attachment to a vacuum source, such as a suction line, to collect debris such as airborne particles. The suction nozzle includes a tubular-shaped funnel with a large mouth at one end, to receive and channel airborne debris to the vacuum source. The suction nozzle also includes a connector at an opposite end of the funnel, for connecting the suction nozzle to a vacuum source. The mouth of the funnel may further include an inwardly-extending rim portion, which is shaped to accommodate objects that may be adjacent to the funnel and its mouth. The mouth includes a lip extending inwardly from the rim of the mouth for helping deflect debris inwardly into the funnel. In one embodiment, the rim portion of the funnel mouth may further include a scraper portion which extends inwardly from the rim, toward the interior of the funnel mouth. This scraper portion is useful for helping to remove debris from instruments or other.

15 Claims, 5 Drawing Sheets

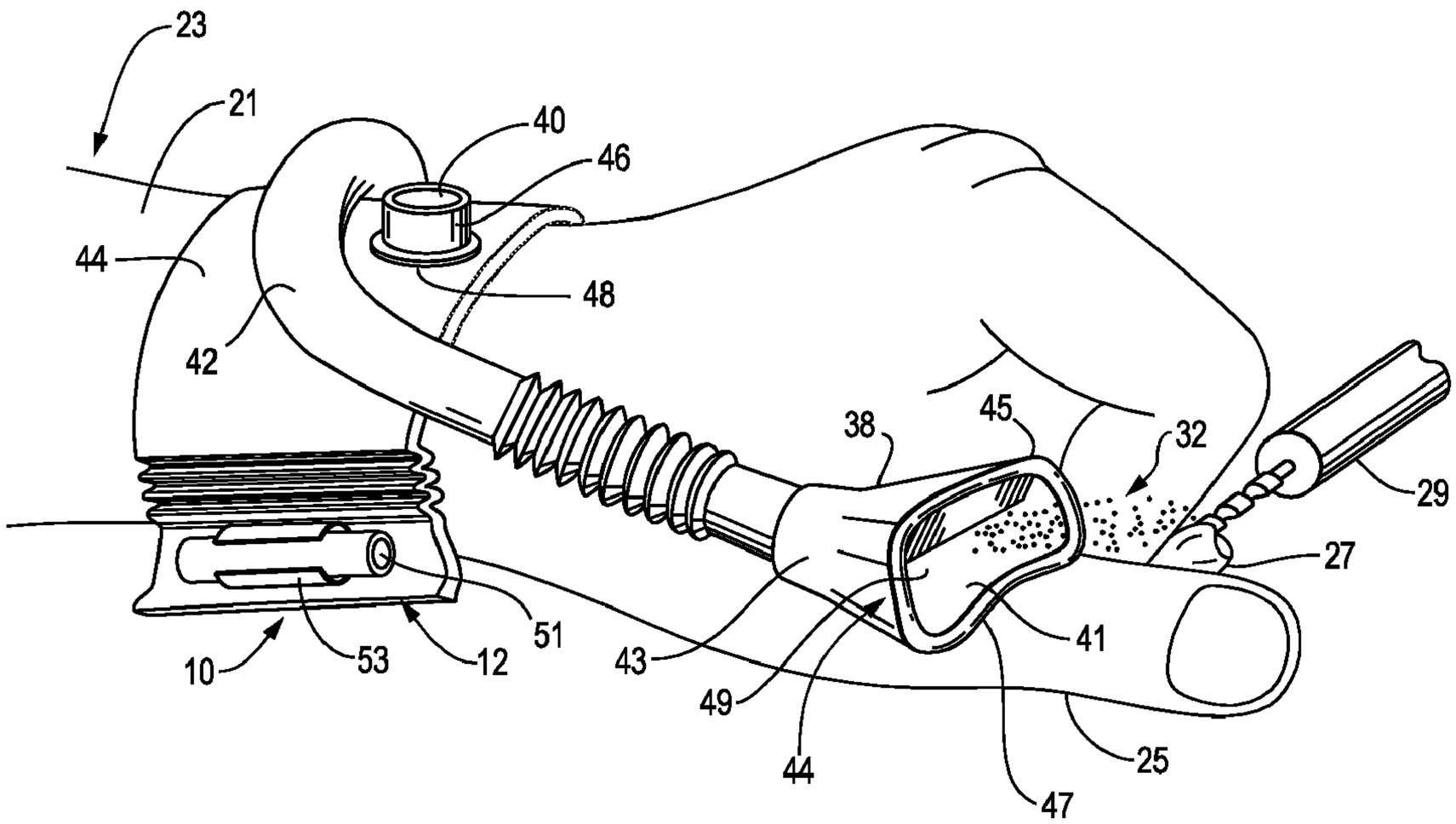

Fig. 1

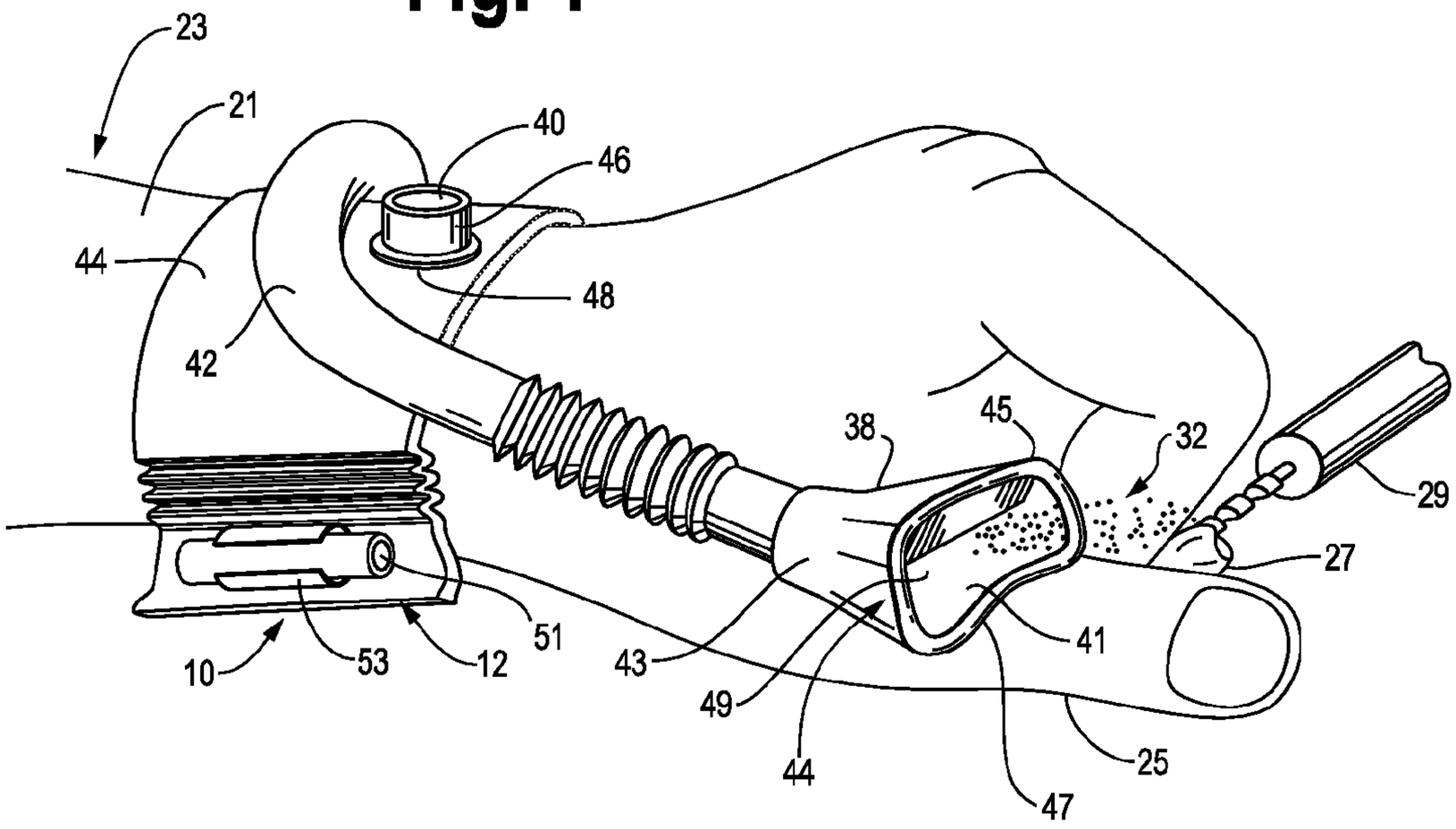
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Fig. 2

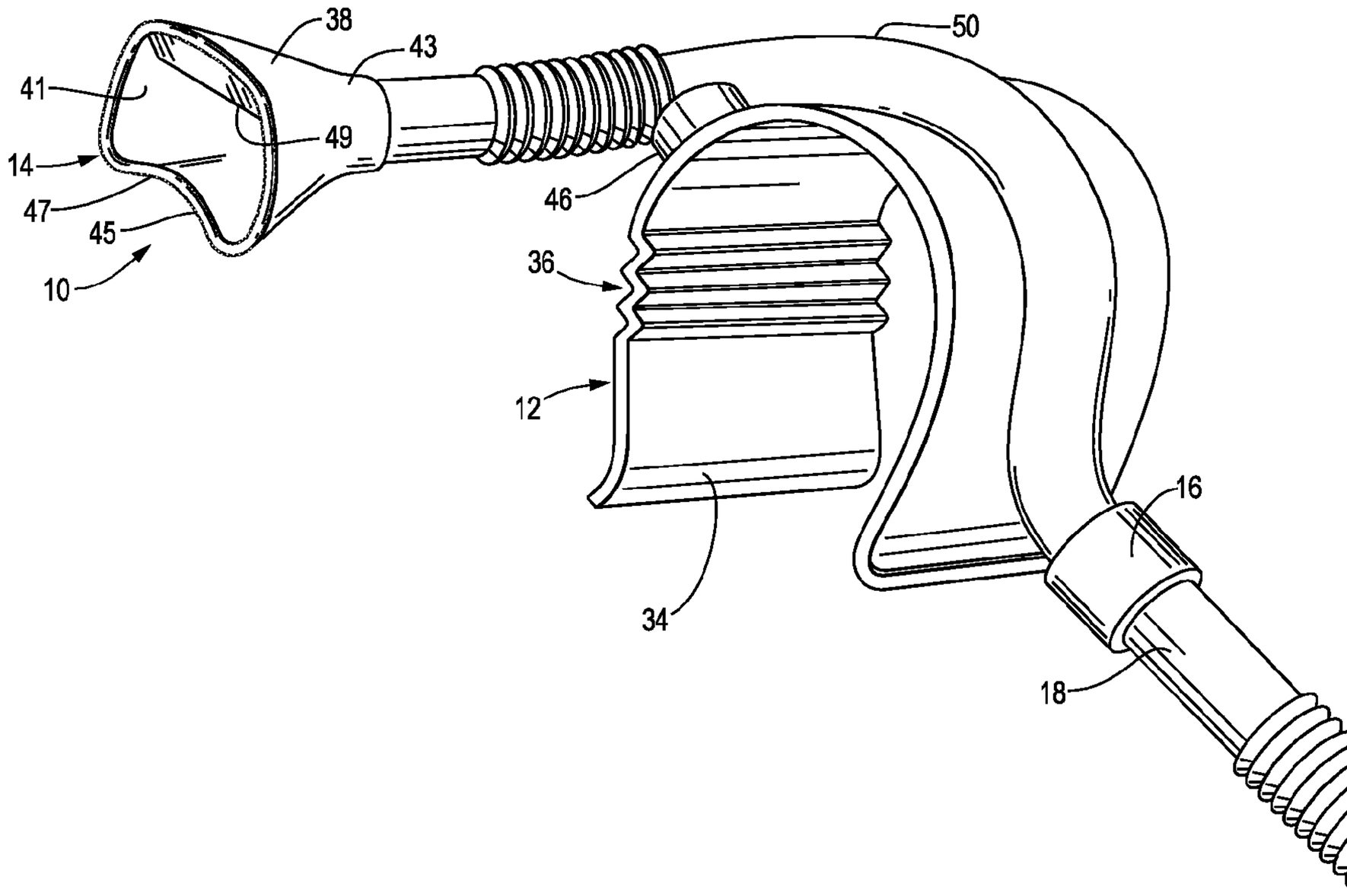
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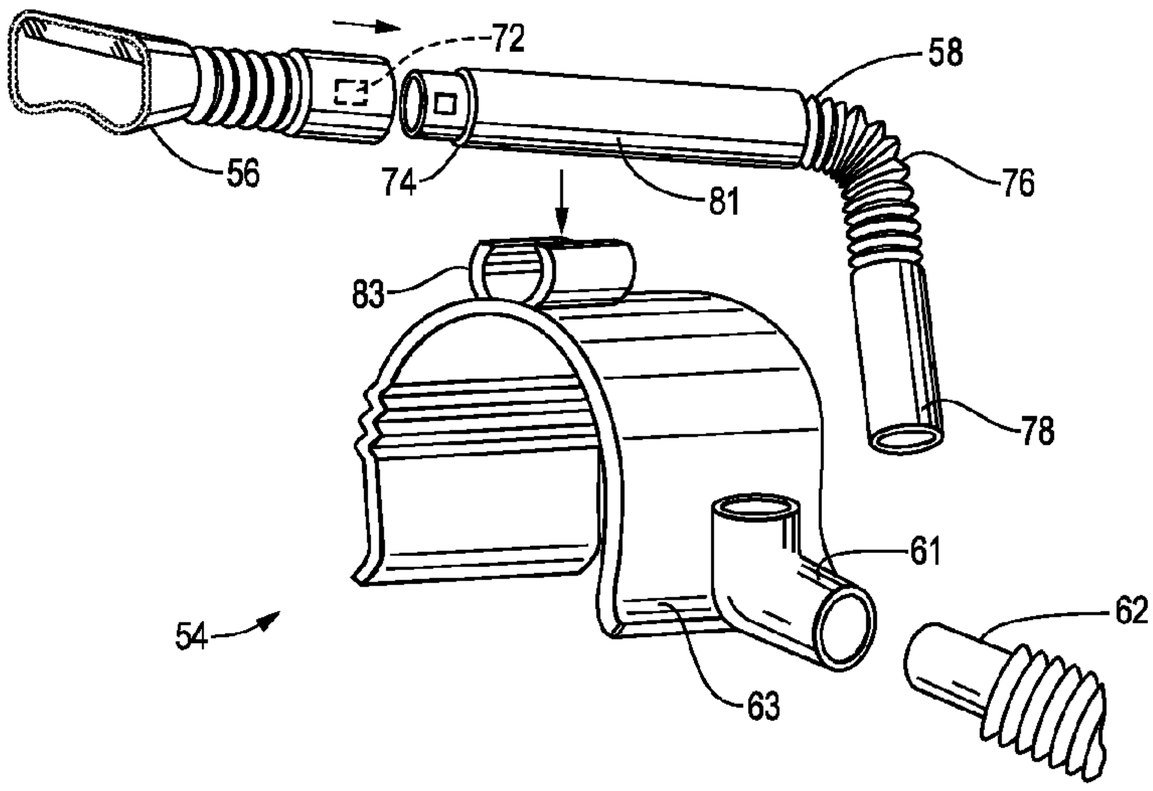
Fig. 3



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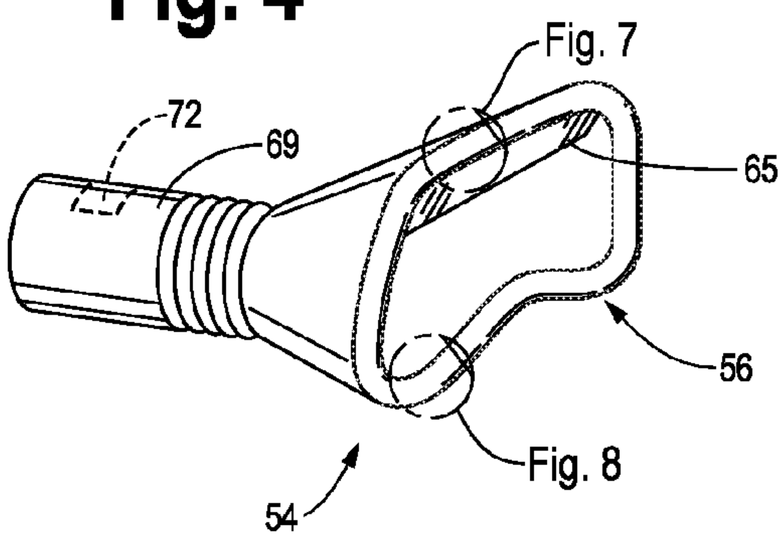

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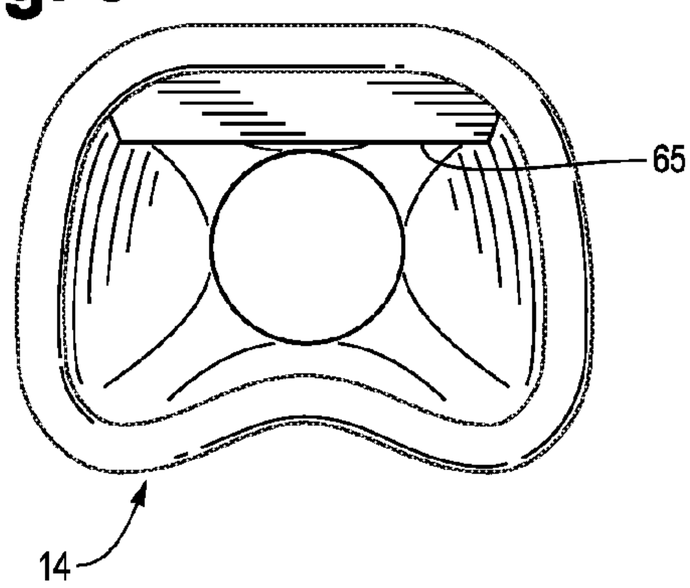

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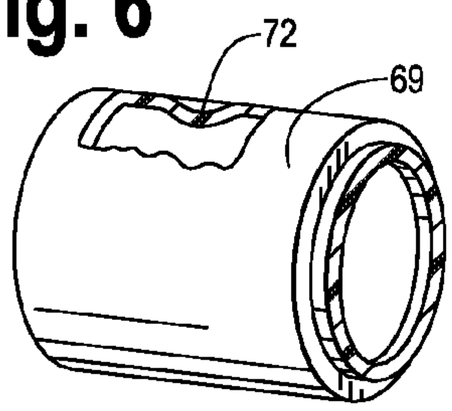
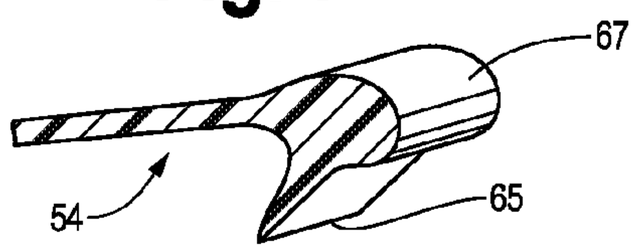


Fig. 7



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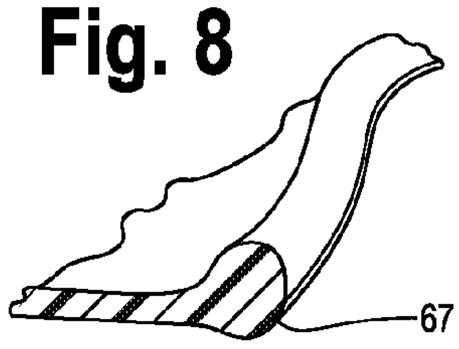


Fig. 9

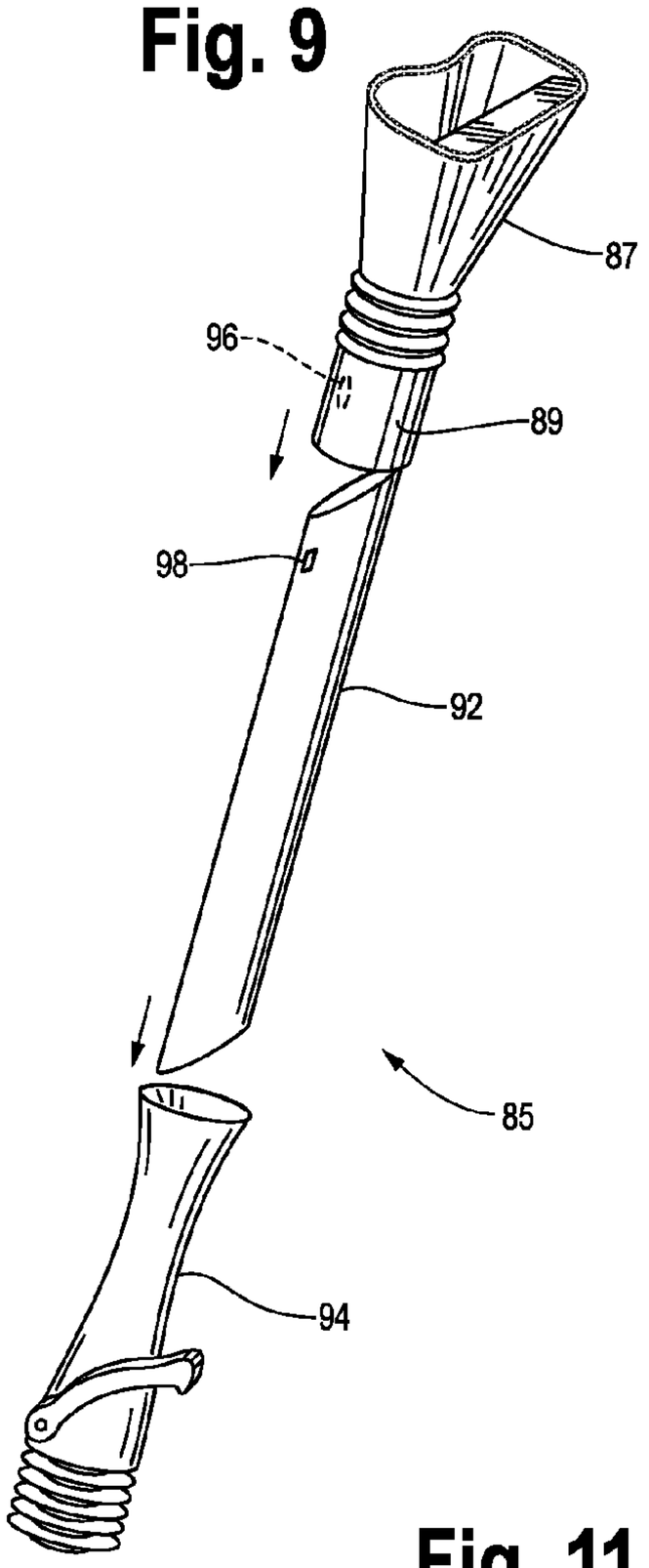


Fig. 10

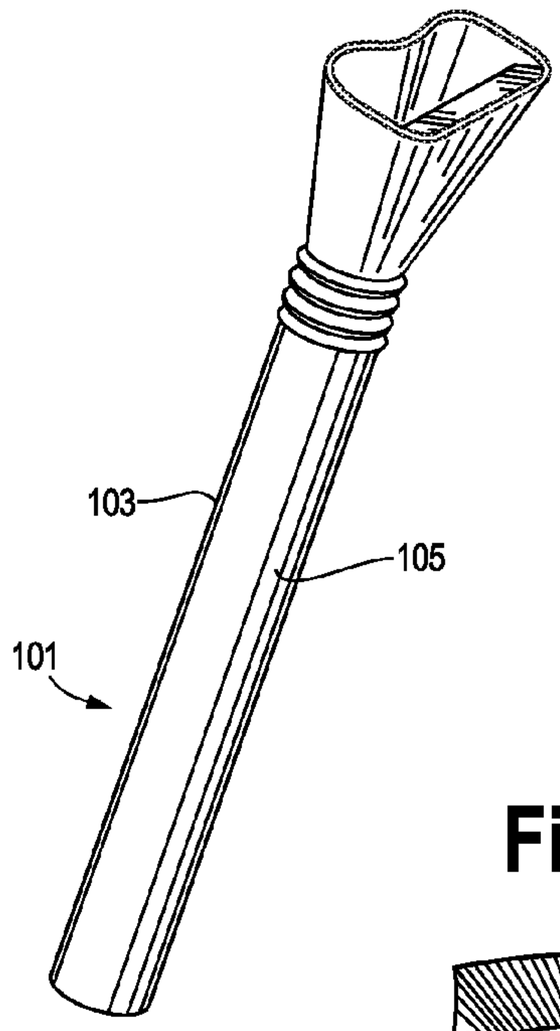
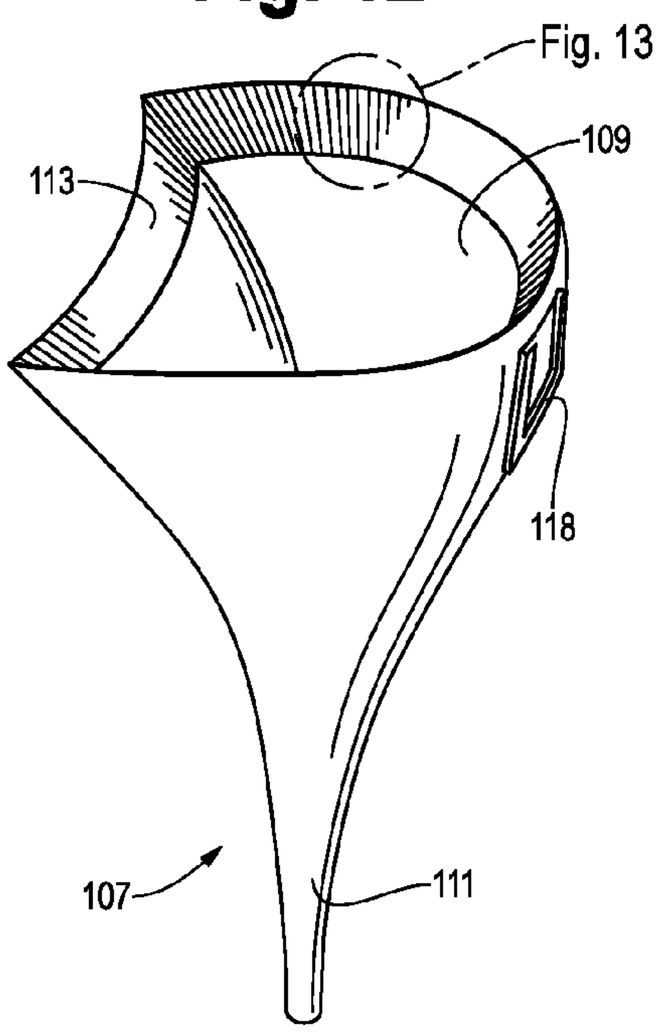


Fig. 12



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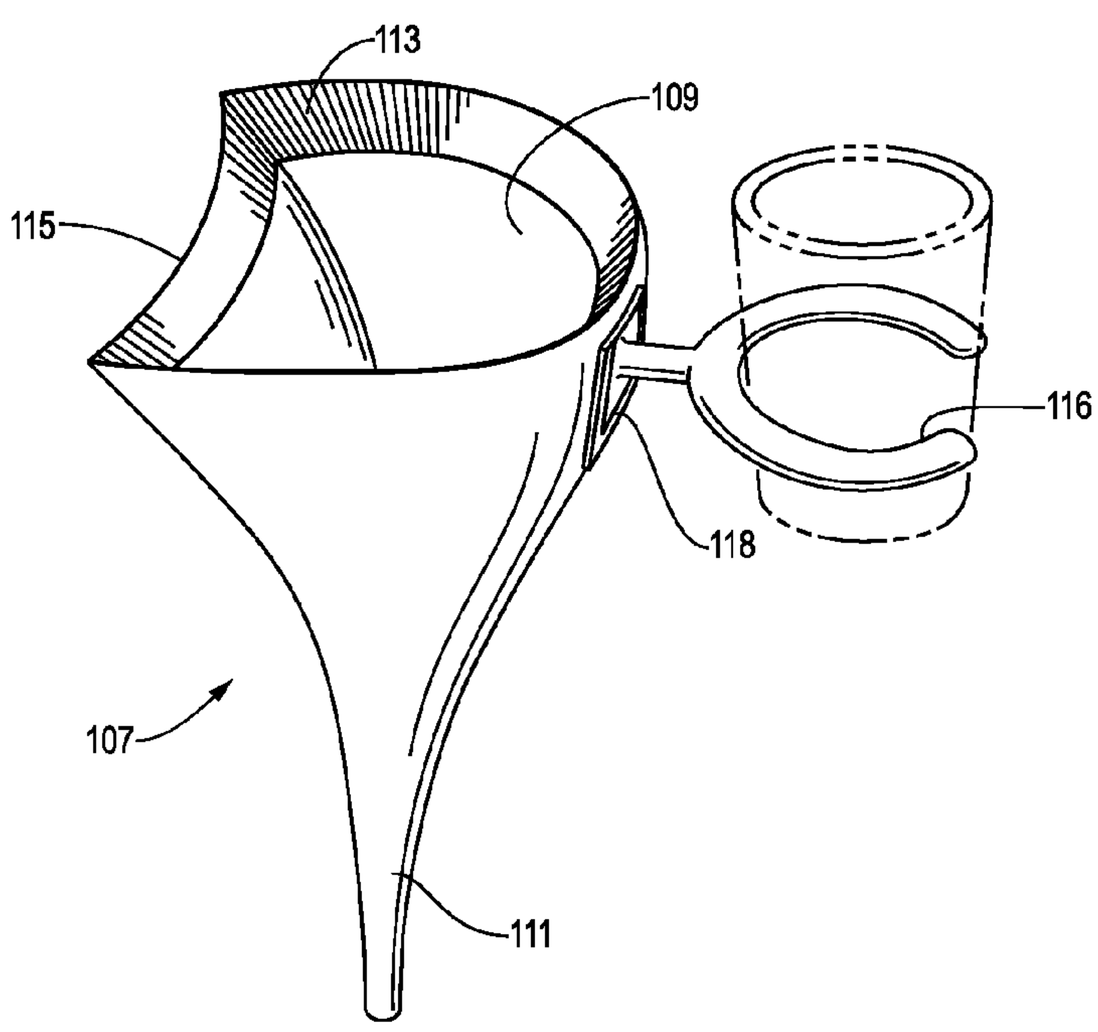

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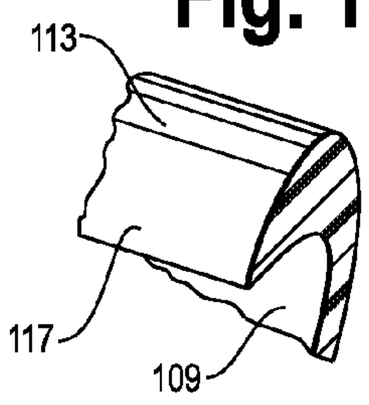
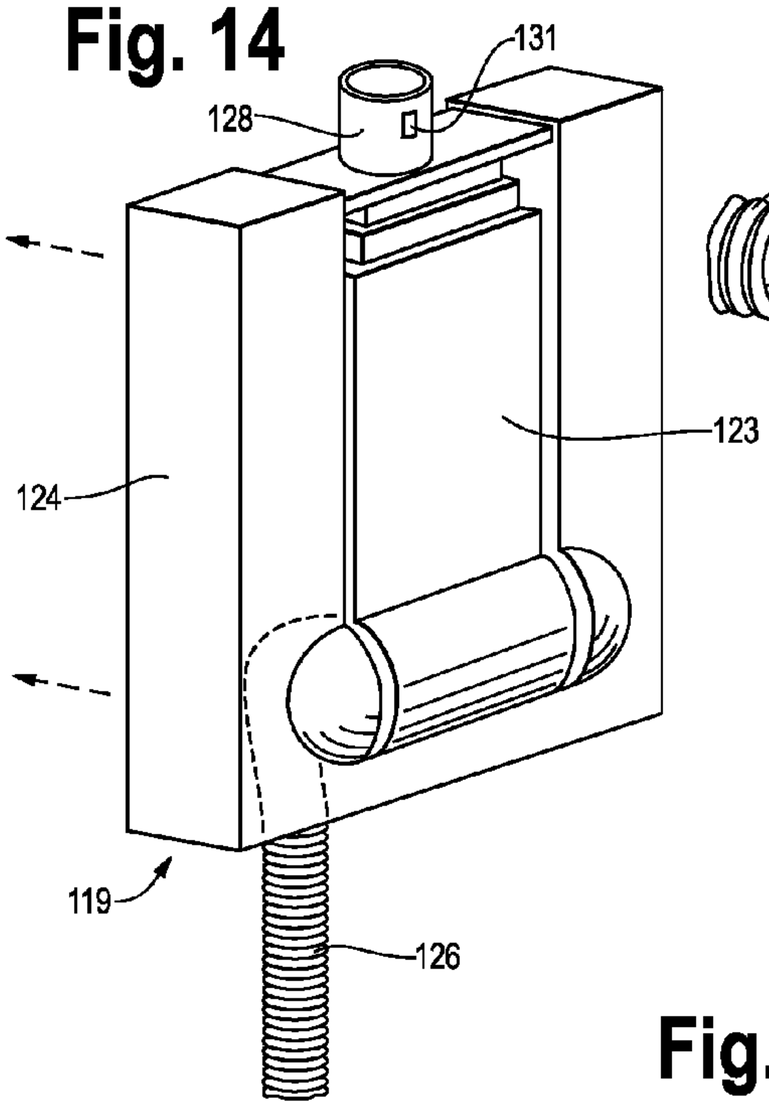


Fig. 14



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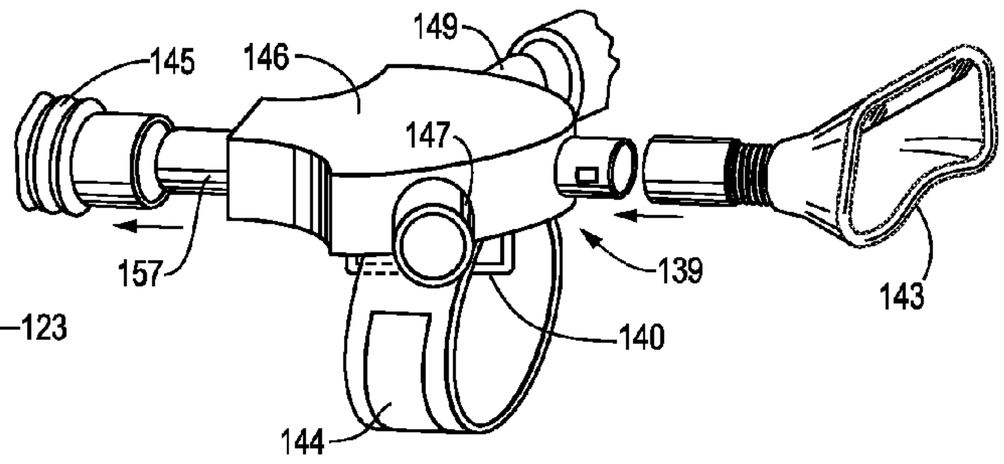


Fig. 15

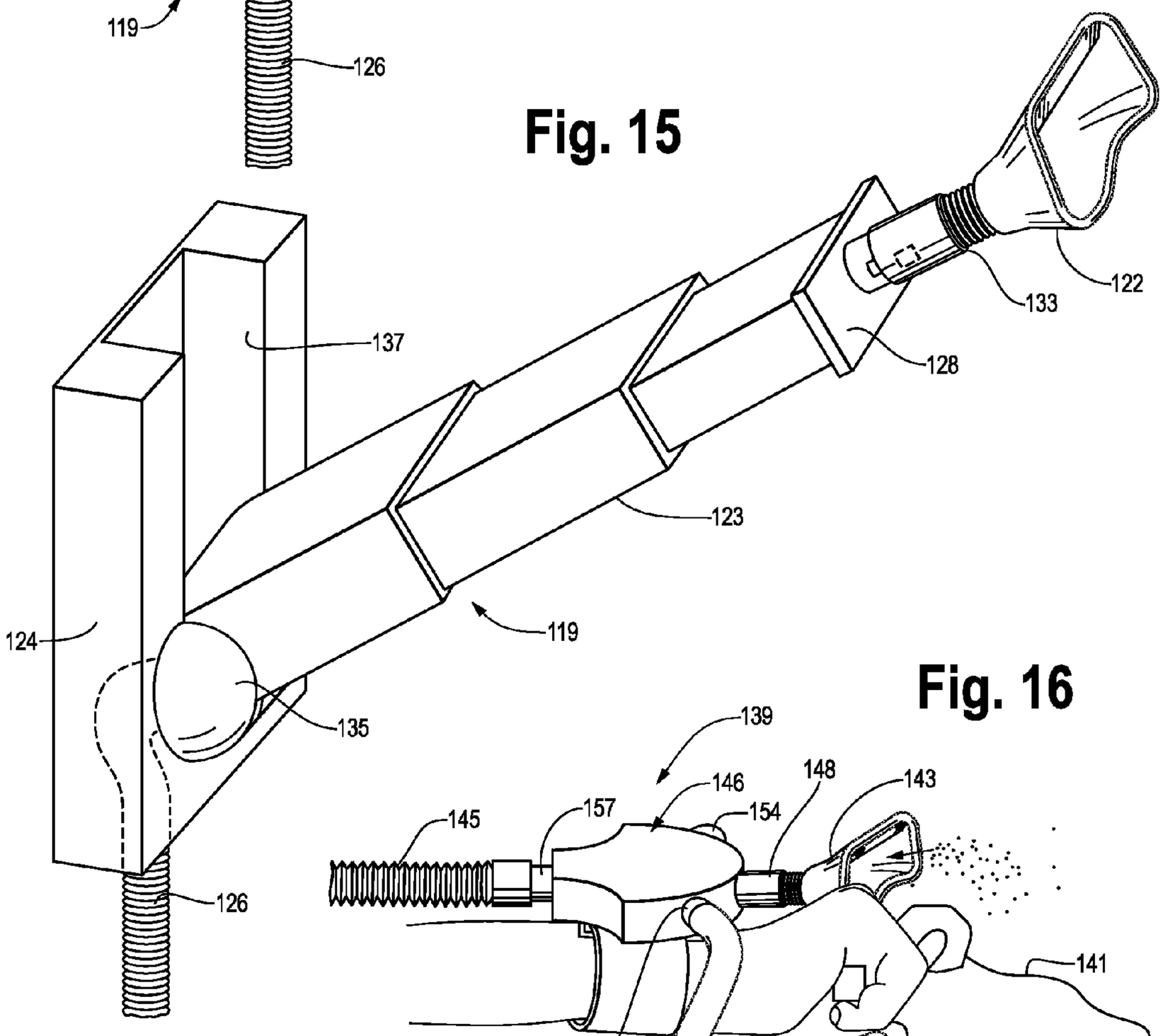


Fig. 16

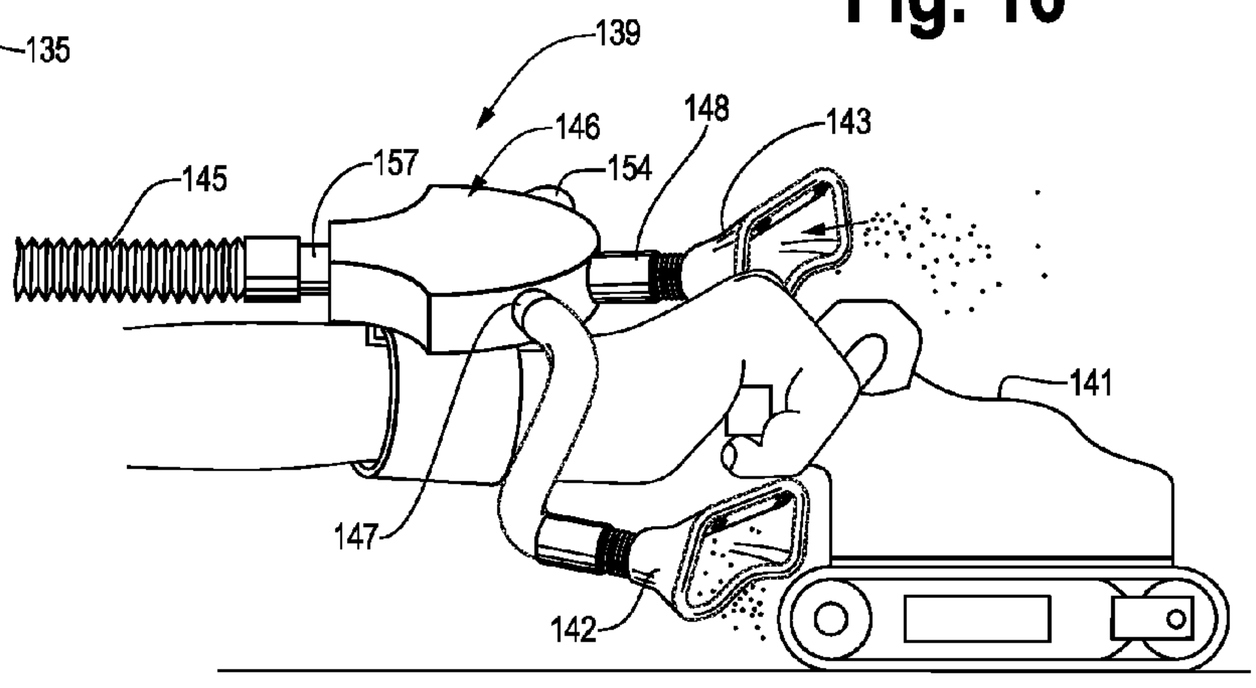


Fig. 18

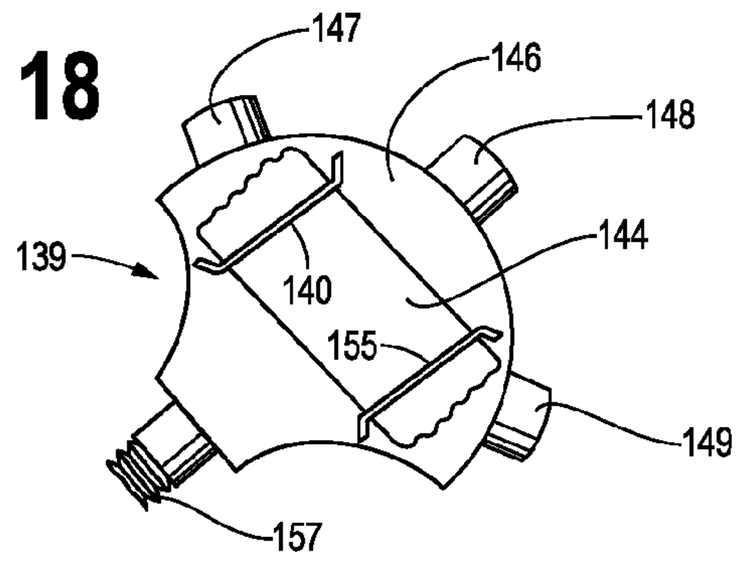


Fig. 19

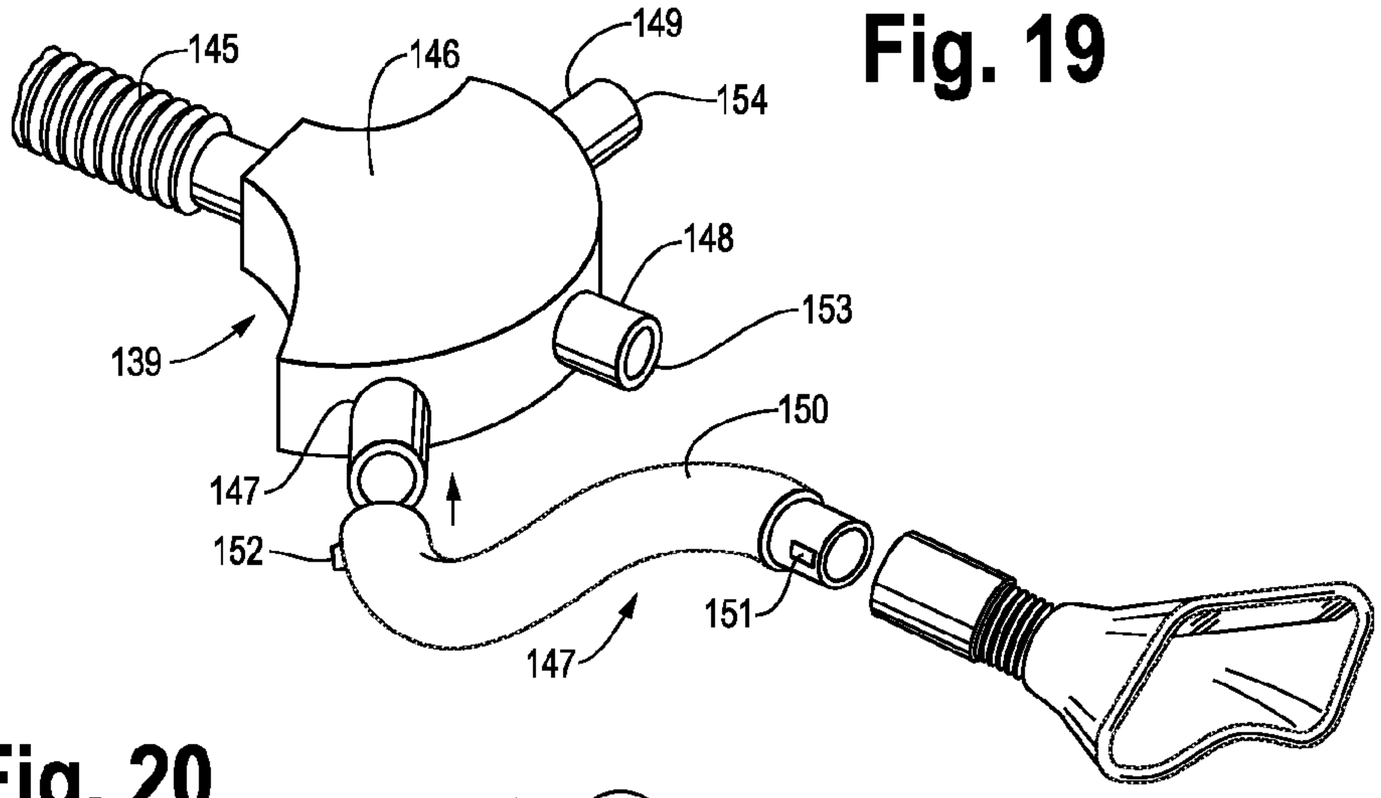


Fig. 20

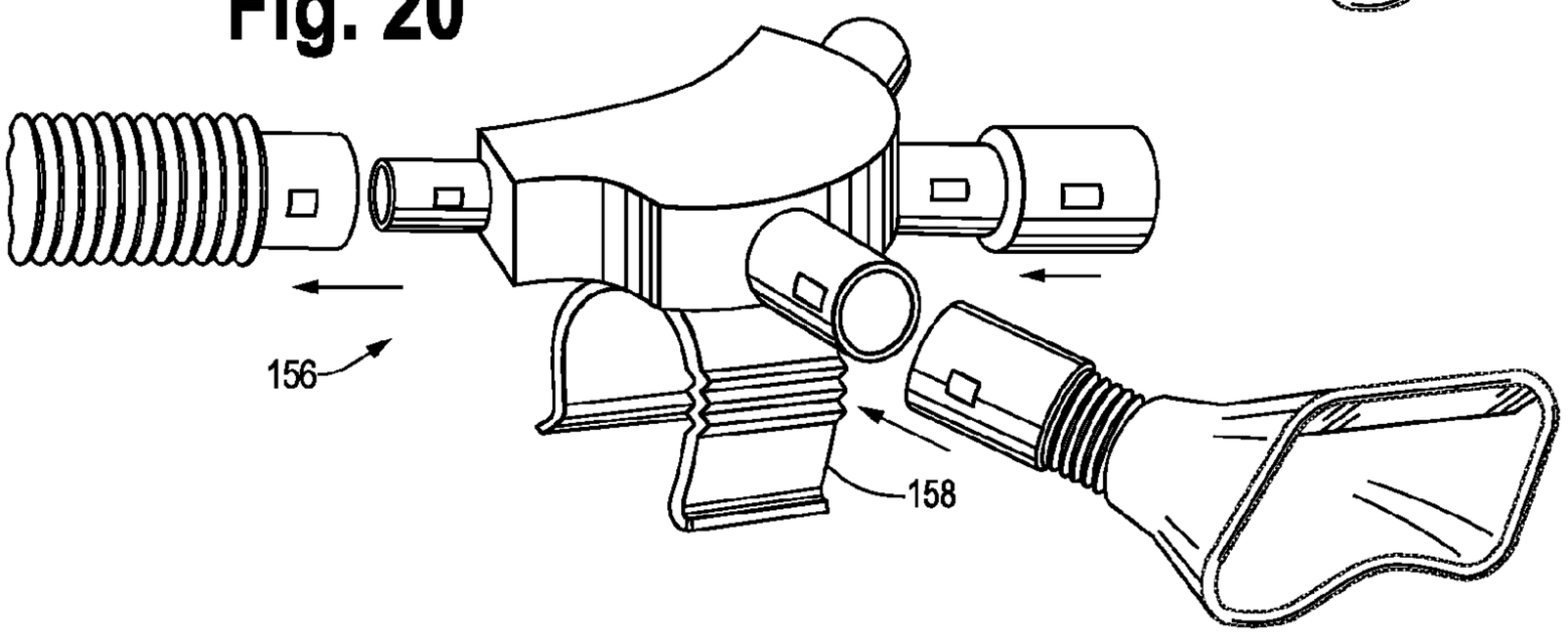
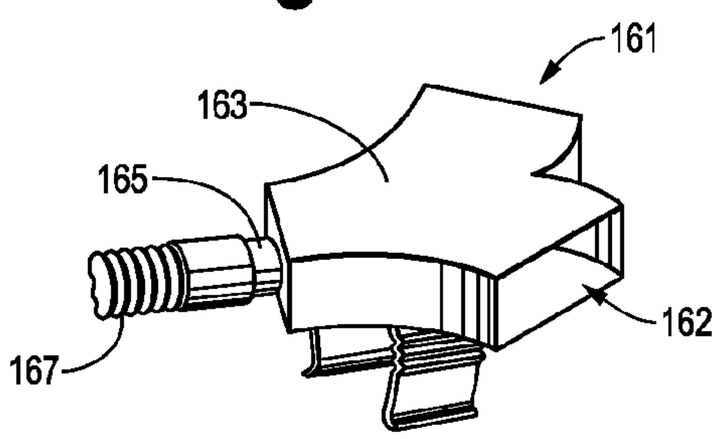


Fig. 21



DEBRIS COLLECTING APPARATUS AND METHODS OF MAKING AND USING THE SAME

RELATED APPLICATION

This application claims priority to U.S. Provisional Patent Application Ser. No. 61/336,891, filed Jan. 28, 2010 and entitled "Chair side dental dust collector suction adapter," which is incorporated herein by reference.

FIELD OF THE INVENTION

This application generally relates to the field of debris-collecting devices, and, more particularly, to suction nozzles connected to a vacuum source for the collection of debris, such as dust particles and others, produced in, and resulting from, a variety of operations such as grinding and machining operations, as well as the operation of power tools and others.

BACKGROUND OF THE INVENTION

There is no admission that the background art disclosed in this section legally constitutes prior art.

As discussed above, this application generally relates to devices for the collection of debris in various environments. This field includes several examples of debris-collecting devices. For instance, U.S. Pat. No. 4,226,054 describes a particle collector that utilizes a vacuum in connection with intercepting and collecting small particles dislodged during grinding operations of dentists and jewelers. U.S. Pat. No. 5,718,016 describes a deformable glove which includes a plurality of flexible suction nozzle tubes that extend along and are deformable with the movement of a user's fingers. The flexible nozzle tubes are connectable to the input port of a vacuum cleaner, so that air may be drawn into the vacuum cleaner through the flexible nozzle tubes as a user moves his or her hand around and along areas to be cleaned. Also, U.S. Pat. No. 4,671,708 discloses a device for collecting debris from grinding, polishing, or other work removal operations, and for simultaneously cooling the work. This device includes a scoop with a base outlet and a suction device for creating a flow of gas through the scoop, to facilitate the induction of debris entering a base outlet of the scoop.

By their nature, grinding and machining processes necessarily result in the generation of debris, such as dust and particles. During grinding and machining operations, very fine particles of dust and material may become airborne and alight on surfaces of the surrounding workplace, creating a dust-covered workplace, or creating potential hazards, depending on the nature of the particles. For example, under certain circumstances, the suspension in air of combustible materials, such as fine sawdust particles, in an enclosed space may create the potential for explosions or other unsafe conditions. In addition, dust and material resulting from a grinding or machining operation may be suspended in the air and may be inhaled by persons in the vicinity of the grinding or machining operation, such as the operator of the grinding tool, an observer of the operation, or other bystander.

Such inhaled particles and material may be injurious to the inhaler, depending on their nature. For example, long-term inhalation of dust may cause respiratory injury, such as lung discomfort, allergic reactions in persons with asthma, or other conditions requiring medical treatment. Furthermore, in some situations, minute particles suspended in the air surrounding a grinding or machining workplace may enter and injure the eyes of persons in the vicinity of the grinding or

machining operation. Such potential health and safety risks may in addition to the increased effort required to clean fine dust and debris particles and maintain a clean workspace environment in the area where such grinding or machining takes place.

Dental practitioners frequently employ small hand-held, or table-top grinding devices, for shaping and polishing dental prostheses. Performing grinding operations on dental prostheses is typically convenient when performed in a dentist's office, while a patient is still seated in a nearby dentist's chair. This allows the dentist or technician to work on the dental prosthetic in the vicinity of the patient, so that the fit of a prosthetic in the patient's mouth may be quickly checked while working on the prosthetic, thus allowing for rapid alternating iterations of work on the workpiece, and fitting in the patient's mouth. A precise fit may thus be achieved quickly, as opposed to working on the workpiece remotely from the patient, if the grinding tools were in a different location such as in a different room or in another facility and having to physically transport the workpiece to a patient located some distance away from the grinding location.

As discussed more generally, above, grinding a dental prosthetic releases particles such as dust, and other debris into the air, which may alight on objects and surfaces in the vicinity of the grinding, thus necessitating frequent and tedious clean-up of small particles. The debris may also become suspended in the nearby air, creating respiratory hazards. In a dental environment, especially where a dental prosthetic is being rapidly cycled between a grinding operation, and fitting in a patient's mouth, other materials from a patient's mouth, such as saliva and blood, may be released into the atmosphere in the course of the grinding operation after the prosthetic has been in the patient's mouth. The release of such materials into the air may present cross-contamination and other health risks for the dentist or technician working on the prosthetic, in addition to those described above such as inhalation and contact with the eyes. Furthermore, other patients may be subject to the same health risks in multi-patient environments, such as in a dental school setting, or multi-patient dentist office. Moreover, the debris and particles released in such grinding operations may alight on a patient's hair and clothing, resulting in discomfort, annoyance, and the need for cleaning. Specialized cleaning procedures may also be required for the work area in which such materials may be released in order, to maintain the cleanliness and sterility of a workspace near dental patients.

BRIEF DESCRIPTION OF THE DRAWINGS

To provide better understanding of the invention and to demonstrate how the same may be carried out in practice, non-limiting embodiments of the invention will now be described with reference to the accompanying drawings, wherein like reference characters refer to like parts throughout the several views, and in which:

FIG. **1** is a pictorial view of an embodiment of the present invention, illustrating use of the invention with a rotary grinder;

FIG. **2** is a pictorial view of the embodiment illustrated in FIG. **1**, illustrating in the process of being used;

FIG. **3** is an exploded disassembled pictorial view of various components of another embodiment of the present invention;

FIG. **4** is an enlarged pictorial view of a debris collecting apparatus of the embodiment of FIG. **3** of the present invention;

FIG. **5** is an enlarged face view of a debris collecting apparatus of the embodiment of the present invention of FIG. **3**;

FIG. **6** is an enlarged pictorial view of a connector portion of the embodiment of the present invention of FIG. **3**;

FIG. **7** is an enlarged detail sectional view of the respective encircled area of FIG. **6**, illustrating a rim and scraper portion of the embodiment of the present invention of FIG. **3**;

FIG. **8** is an enlarged detail sectional view of the respective encircled area of FIG. **6**, illustrating a rounded rim portion of the embodiment of the present invention of FIG. **3**;

FIG. **9** is a pictorial view of another embodiment of the present invention;

FIG. **10** is a pictorial view of yet another embodiment of the present invention, illustrating it in the process of being assembled;

FIG. **11** is a pictorial view of still another embodiment of the present invention;

FIG. **12** is a reduced scale pictorial view of the embodiment of the present invention shown in FIG. **11**, illustrating it with its cup holder removed for illustration purposes;

FIG. **13** is an enlarged detail sectional view of the encircled portion of FIG. **12**;

FIG. **14** is a pictorial view of a further embodiment of a debris collecting apparatus according to the present invention, wherein the apparatus is shown in a stored position with a suction line attached;

FIG. **15** is a pictorial view of the embodiment of the invention illustrated in FIG. **14**, illustrating it in an extended portion, and illustrating the attachment of the vacuum nozzle;

FIG. **16** is a pictorial view of still another embodiment of a debris collecting apparatus according to the present invention, illustrating the use of this embodiment for belt sanding;

FIG. **17** is a pictorial view of the embodiment of a debris collecting apparatus of FIG. **16**, further illustrating it in the process of being connected to a vacuum nozzle and other attachments;

FIG. **18** is a bottom view of the embodiment of the debris collecting apparatus of FIG. **16**, illustrating the manner of attachment of an adjustable band to a manifold, the band being shown broken away for illustration purposes;

FIG. **19** is a pictorial view of the embodiment of a debris collecting apparatus of FIG. **16**, illustrating it in the process of being assembled to an extender tube;

FIG. **20** is a pictorial view of yet another embodiment of a debris collecting apparatus according to the present invention, illustrating it in the process of being assembled; and

FIG. **21** is a pictorial view of a still further embodiment of a debris collecting apparatus in accordance with the present invention, illustrating two open ports.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS OF THE INVENTION

Certain embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all, embodiments of the invention are shown. Indeed, these embodiments of the invention may be in many different forms and thus the invention should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided as illustrative examples only so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

It will be readily understood that the components of the embodiments as generally described and illustrated in the drawings herein, could be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of the certain embodiments of the system, components and method of the present invention, as represented in the drawings, is not intended to limit the scope of the invention, as claimed, but is merely representative of illustrative examples only of the invention.

According to certain embodiments of the present invention, there is provided a suction nozzle for attachment in fluid communication with a vacuum source, such as a suction line, to collect debris, such as airborne particles. The nozzle includes a funnel having a large mouth at one end to receive the debris, and an opposite small end for coupling to the vacuum source. An inwardly extending portion of the mouth may be shaped to accommodate closely spaced adjacent objects such as other such tubes when the inventive suction nozzle is employed, for example, at a dental chair. A lip may extend inwardly from the rim to help deflect debris inwardly in the funnel.

Accordingly, this application discloses a suction nozzle for attachment in fluid communication with a vacuum source, such as a suction line, to collect debris. The suction nozzle includes a tubular-shaped funnel with a large mouth at one end, to receive and channel airborne debris to the vacuum source. The suction nozzle also may include a connector at an opposite end of the funnel, for connecting the suction nozzle to a vacuum source. The mouth of the funnel further may include an inwardly extending rim portion, which is shaped to accommodate objects that may be adjacent to the funnel and its mouth. The rim portion of the funnel mouth may further include a scraper portion, and which extends inwardly from the rim, toward the interior of the funnel mouth. This scraper portion is useful for helping to remove debris from instruments or other.

For the convenience of the user, the debris-collecting apparatus disclosed in this application may also be configured to be mounted to an operator's limb, near an operator's digit, so that it may be positioned close to a hand-held grinder and workpiece while the user is grinding or machining the workpiece. In another embodiment, the debris-collecting apparatus may be attached to a telescoping tube that is rotatably mounted to a wall in the vicinity of the working area.

According to another embodiment of the present invention, a funnel-shaped nozzle includes a lip extending inwardly from the rim of the nozzle mouth, to prevent debris, liquid, and other materials that may enter the nozzle mouth, from bouncing or splashing out of the nozzle.

According to yet another embodiment of the present invention, a nozzle assembly includes a tubular funnel-shaped nozzle with a large mouth for receiving debris at one end, and a small connector portion at the other end for attaching the nozzle to a vacuum source. According to an aspect of this embodiment, the nozzle mouth may include a rim that extends inwardly along at least a portion thereof, to accommodate objects adjacent to the nozzle. According to another aspect of this embodiment, a scraper may extend inwardly from the rim of the nozzle mouth, for helping remove debris from instruments. The nozzle assembly may further include a cuff attached to the funnel-shaped nozzle, for attachment of the nozzle assembly to a user's limb.

According to another embodiment of the present invention, a nozzle assembly includes a manifold having a number of ports, and a small connector portion for attaching the nozzle assembly to a vacuum source, such as a suction line. Such a nozzle assembly may further include at least one tubular funnel-shaped nozzle attached to one or more of the ports, and each of the funnel-shaped nozzles may have a large mouth. In

an aspect of this embodiment, the nozzle assembly may include a cuff for attaching the nozzle assembly to a user's limb.

A further embodiment relates to the method of using the nozzle assembly as being worn by the user during use. Also another embodiment relates to the method of making the nozzle of the present invention.

Referring now, to the drawings, FIGS. **1** and **2** illustrate an embodiment of the debris collecting apparatus **10** according to the present invention. The debris collecting apparatus **10** includes a wrist-engageable portion, or cuff **12**, and a suction nozzle **14**. As illustrated in FIG. **2**, a connector **16** provides for attachment of the debris collecting apparatus **10** to a vacuum source such as a suction line **18**. Many types of connectors are known in the art for attaching lengths of tubing, such as suction line, to each other, or for the attachment of various types of attachments to tubing. Such connectors known in the art may include detachable, or quick-disconnect connectors for disconnection for cleaning, storage, maintenance, or the quick change of suction line attachments. It is thus to be appreciated that, in keeping with the scope of the present invention, any appropriate connecting method known in the art may be used for attaching the debris collecting apparatus **10** to a suction line **18**.

As further contemplated by an embodiment of the present invention the cuff **12** provides for attachment of the debris collecting apparatus **10** to a portion of a user's limb **23**, such as a user's wrist **21**, as illustrated in FIG. **1**. Attaching the debris collecting apparatus **10** to the user's limb **23** facilitates the positioning of the suction nozzle **14** in close proximity with, or in contact with a user's digit, such as the user's thumb **25**.

FIG. **1** further illustrates that the suction nozzle **14** may thus be positioned in close proximity to a workpiece such as a dental prosthetic **27**, as a user is holding the workpiece **27** with the limb **23** to which the debris cleaning apparatus **10**, is attached and performing a grinding operation on the workpiece **27** with a grinding tool **29**. This proximate location of the suction nozzle facilitates effective capture and suction of dust **32** that is generated by the operation of the grinding tool **29** on the workpiece **27**. Referring again to FIG. **2**, it may be seen that the cuff **12** may be formed as a C-shaped, one-piece band **34**, in keeping with an embodiment of the present invention. The one-piece band **34** may include a corrugated portion **36**, secure fit, adjustability, and ease of attachment to a user's limb **23**.

FIGS. **1** and **2** further illustrate a suction nozzle **14** in keeping with an embodiment of the present invention. The suction nozzle **14** may include a tubular funnel-shaped member **38**, which forms a large generally rectangularly shaped mouth **41**. A small connecting portion **43** may extend from an end of the suction nozzle **14** opposite the large mouth **41**. The large mouth **41** may include a rim **45**, disposed peripherally at the large mouth **41**, and formed integrally therewith. The rim **45** may include an inwardly extending portion **47**, configured to accommodate a user's digit, such as a thumb **25**, or some other object that may be adjacent to **48** the suction nozzle **14**. The suction nozzle **14** may also include an inwardly inclined lip or flange serving as a scraper portion **49**, disposed along a portion of the rim **45**, which scraper portion **49** is useful for scraping debris from the grinding tool **29**, or other implement being used in proximity of the suction nozzle **14**. The lip or scrapper extends angularly inwardly to help prevent debris from bouncing or splashing out of the funnel-shaped member **38**.

In an embodiment of the present invention, the suction nozzle **14** may be connected to a curved suction tube **50** that is connected to the one-piece band **34** and to the suction line **18**. The curved suction tube **50** may include a flexible joint **52** at some point along its length. As illustrated in FIG. **1**, while the suction tube **50** may be curved so as to bias the suction nozzle against a user's digit, such as a thumb **25**, the flexible joint allows for free movement of the digit **25**, as the user is manipulating a workpiece **27**. The suction nozzle **14** may thus remain in close proximity to a workpiece **27**, through the range of motion of the user's digit **25**, in order to effectively collect dust **32** generated as a workpiece **27** is manipulated in a grinding process.

The cuff **12** includes an upper rounded surface **44** which has a prophy paste cup **46** mounted thereon. The prophy paste cup is held in place by a pro-fee paste cup holder **48** so that the cup **46** contains a supply of prophy paste **40** which is worn on the limb of the user so that the user can conveniently gain access to the prophy paste **40** during a dental cleaning procedure.

A gauze roll **51** is detachably mounted on one side of the cuff **12** and is detachably held in place by a gauze holder **53**. In this manner, the user can conveniently use the gauze roll **51** for cleaning the instruments during a dental procedure for a patient (not shown). The gauze roll can be conveniently removed after the dental procedure is completed, and a fresh new roll may be secured to the cuff **12** by means of the holder **53**.

Referring now to FIGS. **3** through **8**, there are illustrated embodiments of the debris collecting apparatus **54**, in accordance with the present invention. The embodiment illustrated in FIG. **3** is similar to the embodiment shown in FIGS. **1-2**, except that several components of the debris collecting apparatus **54** are detachably connected as parts of an assembly, in contrast to the unitary 1-piece construction of the debris collecting apparatus **10** shown in FIG. **1**. Detachable connections may facilitate cleaning and maintenance of the debris collecting apparatus **54**, as well as quick disconnection from, changes of attachments to, a vacuum device such as a suction line **62**. FIG. **3** shows that a suction nozzle **56** according to the present invention, may be detachably connected to a removable curved suction tube **58**. Removable curved suction tube **58** may be detachably connected to an L-shaped connector **61**, which is attached to the C-shaped band **63**.

The suction nozzle **56** illustrated in FIGS. **3** through **8**, is similar to the suction nozzle illustrated in FIGS. **1-2**, in that suction nozzle **56** also includes a scraper portion **65**. As seen in FIGS. **7-8**, scraper portion **65** of suction nozzle **56** may be configured as a V-shaped knife edge. As further illustrated in FIGS. **7-8**, suction nozzle **56** may include a bulbous rounded rim **67**. FIGS. **4** and **6** illustrate a small tapered connector portion **69**, which is similar to connector portion **43**, shown in FIGS. **1-2**, except that connector portion **69** includes a detent which is receivable by an opening **74** in the removable curved suction tube **58** illustrated in FIG. **3**, to provide a detachable connection.

Referring again to FIG. **3**, there is seen a curved suction tube **58**, with an end **78** that detachably connects with L-shaped connector **61**. Curved suction tube **58** may also include a flexible joint **76**, to accommodate positioning around C-shaped band **63**, and to provide adjustable positioning and freedom of motion of the suction nozzle **56**, which may be detachably connected to the removable suction tube **58**. L-shaped connector **61** may provide for connection of the debris collecting apparatus **54**, to suction line **62**. Curved suction tube **58** may also include an intermediate portion **81**, which is removably connectable to clamp **83**, which itself may be disposed on C-shaped band **63**, for positioning and stability of curved suction tube **58**.

An additional embodiment of the debris collecting apparatus **85** of the present invention is illustrated in FIG. **9**. There is seen a suction nozzle **87**, that includes a small straight connector portion **89**. Small straight connector portion **89** is similar to small tapered connector portion **69**, except that it is straight, rather than tapered. The debris collecting apparatus **85** of the embodiment illustrated in FIG. **9** is similar to the debris collecting apparatus **10**, described above, except that in the embodiment shown on FIG. **9**, small straight connector portion **69** may be detachably connected to coupler tube **92**, which may be, in turn, detachably connected to a vacuum source such as a suction line **94**. Similarly to the detent **72** disposed on small tapered connector portion **69**, small straight connector portion **89** may include a detent **96**, that is accessible by an opening **98**, in coupler tube **92**, to facilitate a quickly detachable connection between small straight connector portion **89** and coupler tube **92**.

FIG. **10** illustrates an embodiment of the debris collecting apparatus **101** of the present invention, which embodiment is similar to debris collecting apparatus **10**, described above, except that debris collecting apparatus **101** includes a suction nozzle **103** that is similar to suction nozzle **87**, but includes a long tubular neck portion **105**, for connecting to a vacuum source such as a vacuum line **94** (shown in FIG. **9**).

FIGS. **11** through **13** illustrate yet another embodiment of a debris collecting apparatus **107**, in accordance with the present invention. The debris collecting apparatus shown in FIGS. **11-13** includes a large mouth **109**, and a small connector portion **111** disposed at an end of the debris collecting apparatus **107** that is opposite the large mouth **109** thereof. FIG. **13** shows a detailed view of a mouth rim **113**, that is disposed on, and extends along at least a portion of the large mouth **109**. The mouth rim **113** includes an inwardly extending portion **115**, that is similar to the inwardly extending portion **47** of the debris collecting apparatus **10** illustrated in FIGS. **1-2**. However, the mouth rim **113** illustrated in FIG. **13** may include a lip or V-shaped flange **117**, configured to prevent debris, liquid, or materials that enter the debris collecting apparatus **107**, from bouncing or splashing out of the debris collecting apparatus **107**.

The apparatus **107** is designed to collect debris in general, but its presently preferred use is to receive spittle from a dental patient (not shown) seated in a dental chair (not shown) to eject unwanted debris from the mouth of the patient. A cup holder **116** may be provided on the apparatus **107** to releasably hold a drinking cup (not shown) which may be filled with water or other mouth rinse to facilitate the patient to rinse his or her mouth with water to remove debris from the mouth. A bracket **118** on the outside of the apparatus **107** enables the holder **116** to be removed therefrom for convenient cleaning or storage.

FIGS. **14-15** illustrate yet another embodiment of a debris collecting apparatus **119**, in accordance with the present invention. As shown in FIG. **15**, debris collecting apparatus **119** includes a suction nozzle **122** detachably connected to a telescoping tube **123**, that is rotatably attached to a housing **124** that may be, on turn, attachable to a wall or other surface conveniently located near a location where grinding or machining frequently occurs. The housing **124** is connected to a vacuum source such as a suction line **126**. An adapter **128** may be disposed at the free end of the telescoping tube **123**. Adapter **128** includes a detent opening **131**, for receiving detent **133**, disposed on suction nozzle **122**, for detachably connecting suction nozzle **122** to adapter **128**, in similar fashion as detents **72** and **96** are received by respective openings **74** and **98**, for the detachable connection of respective suction nozzles **56** and **87**. Telescoping tube **123** and housing **124** may be configured to provide for fluid communication between the suction line **126** connected to the housing **124**, and the suction nozzle **122** connected to adapter **128**. A hinge **135** may be provided as part of the housing **124**, for the rotatable connection of telescoping arm **123**, and housing **124** may also include a pocket opening **137**, for receiving telescoping arm **123** when it is collapsed and rotated toward housing **124**, for storage, as illustrated in FIG. **14**.

FIGS. **16-19** illustrate yet another embodiment of a debris collecting apparatus **139**, according to the present invention. As shown in FIG. **18**, band retainers **140**, **155** may be provided, to receive an adjustable band **144** for encircling a portion of a user's limb, for example, a user's wrist. This allows the debris collecting apparatus **139**, to passively remain in close proximity to a grinding operation being performed by a user, and thus effectively collect dust and debris generated during the process, without the user having to actively grasp the debris collecting apparatus **139**. As a result, the user can utilize the limb to which the debris collecting apparatus **139** is attached, for the performance of the work at hand, thus freeing up other limbs for assistance with the task, for holding a workpiece, or for the user to brace or support herself.

As further illustrated in FIG. **16**, when attached to a user the debris collecting apparatus remains in close proximity to a power tool **141** such as a belt sander, as it is operated by a user. The debris collecting apparatus **139** includes suction nozzles **142**, **143**, positioned to effectively capture dust and debris generated by the power tool **141**. Suction nozzles **142**, **143** are connected to a manifold **146**, which is, in turn, connected to a vacuum source such as a suction line **145**.

As seen in FIG. **19**, manifold **146** may include ports **147**, **148**, **149**, to which suction nozzles **142**, **143** may be detachably connected. It is to be appreciated that other embodiments may include any number of open ports without deviating from the inventive concept. As shown in FIG. **17**, manifold **146** may also include a vacuum connector **157**, similar to vacuum connector **16**, as described above, to provide for a detachable connection to suction line **145**. In addition, to better position suction nozzle **142** in relation to the workspace or workpiece, for effective debris collection, extender tube **150** may be attached to port **147**, and suction nozzle **142** may be, in turn, attached to extender tube **150**. To provide for a detachable connection between extender tube **150** and suction nozzle **142**, similarly to the detachable connection provided by the engagement and disengagement of detent **72** with opening **74** described above, extender tube may include a detent opening **151**, for receiving a detent disposed on suction nozzle **142**. To similarly provide for a detachable connection between extender tube **150** and port **147**, a detent **152** may be disposed on extender tube **150**, which detent **152** is receivable by an opening on port **147**.

As illustrated in FIG. **19**, caps **153**, **154** may be provided in connection with an embodiment of the present invention, to cover ports **148**, **149**, when they are not in use. When a suction nozzle **142** is connected to port **147**, either directly, or indirectly, through connection to extender tube **150**, covering unused ports **148**, **149** with caps **153**, **154** may beneficially facilitate greater suction force through port **147**.

FIG. **20** illustrates another embodiment of the debris collection device **156**, in accordance with the present invention. In this embodiment, a C-shaped band, similar to C-shaped band **34** described above, may be attached to debris collection device **156**, for quick and convenient removable attachment to a user's limb.

FIG. **21** illustrates yet another embodiment of the debris collection device **160**, in accordance with the present inven-

tion. This embodiment includes a manifold **163** with two open ports **161**, **162** for collection of debris when the debris collection device **160** is connected to a vacuum source, such as a suction line. The arrangement of open ports **161**, **162** provides for the collection of debris generated on either side of a user's limb when the debris collection device **160** is connected to a vacuum source, and attached to a user's wrist. It is to be appreciated that other embodiments may include any number of open ports without deviating from the inventive concept. Manifold **146** may also include a vacuum connector **165**, similar to vacuum connector **16**, as described above, to provide for a detachable connection to suction line **167**.

Although the invention has been described with reference to the above examples, it will be understood that many modifications and variations are contemplated within the true spirit and scope of the embodiments of the invention as disclosed herein. Many modifications and other embodiments of the invention set forth herein will come to the mind of one skilled in the art to which the invention pertains, having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention shall not be limited to the specific embodiments disclosed and that modifications and other embodiments are intended and contemplated to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A suction nozzle for attachment in fluid communication with a vacuum source, to collect debris, the nozzle comprising:

a tubular funnel-shaped member having a large mouth at one end, for receiving the debris, and having a small connector portion at an opposite end for attaching the nozzle to the vacuum source;

the mouth having a rim with one portion thereof extending inwardly toward the center of the mouth, for accommodating adjacent objects; and

a scraper portion integral with, and extending inwardly from, the rim, for helping remove debris from instruments.

2. A suction nozzle according to claim **1**, wherein the tubular member is a one-piece construction composed of a plastic material.

3. A method of making the suction nozzle of claim **1**, further including molding the nozzle from a plastic material.

4. A suction nozzle according to claim **1**, wherein the nozzle includes a cuff for attaching the nozzle to a limb of a user.

5. A suction nozzle according to claim **1**, wherein the nozzle is attachable to a telescoping arm, the telescoping arm being, in turn, attached to a housing attachable in fluid communication with the vacuum source.

6. A suction nozzle according to claim **5**, wherein the telescoping arm is rotatably attached to a housing.

7. A suction nozzle according to claim **1**, wherein the nozzle is attached to a coupler tube that is, in turn, attachable in fluid communication with the vacuum source.

8. A suction nozzle for attachment in fluid communication with the vacuum source, to collect debris, the nozzle comprising:

a tubular funnel-shaped member having a large mouth at one end, for receiving the debris, and having a small connector portion at an opposite end for attaching the nozzle to the vacuum source;

the mouth having a rim with one portion thereof extending inwardly toward the center of the mouth, for accommodating adjacent objects; and

a lip extending inwardly from, the rim, for helping deflect debris inwardly into the funnel-shaped member, to help prevent debris from bouncing or splashing out of the funnel-shaped member.

9. A suction nozzle according to claim **8**, further including attaching means for securing the nozzle to a limb of the user, said means having a holder for securing releasable thereto an absorbent cleaning material.

10. A suction nozzle according to claim **9**, further including a device for attaching removably a prophy paste cup to said attaching means.

11. A suction nozzle assembly for attachment to a user's limb, and attachment in fluid communication to a vacuum source, to collect debris, the nozzle assembly comprising:

a tubular funnel-shaped member having a large mouth at one end, for receiving the debris, and having a small connector portion at an opposite end for attaching the nozzle to the vacuum source;

the mouth having a rim with one portion thereof extending inwardly toward the center of the mouth, for accommodating adjacent objects;

a scraper portion integral with, and extending inwardly from, the rim, for helping remove debris from instruments; and

a cuff attached to the funnel-shaped member, for attaching the nozzle assembly to a user's limb.

12. The nozzle assembly of claim **11**, wherein the funnel-shaped member includes a flexible joint disposed between the small connector portion, and the rim of the mouth.

13. The nozzle assembly of claim **12**, wherein the cuff includes a corrugated portion.

14. A method for making a nozzle for the collection of debris, the method comprising:

providing a tubular funnel-shaped member which member has a large mouth at one end, for receiving the debris, and which member has a small connector portion at an opposite end for attaching the nozzle in fluid communication to the vacuum source; and

providing a scraper portion integral with, and extending inwardly from, the rim, for helping remove debris from instruments.

15. The method of claim **14**, further including the step of attaching a cuff to the funnel-shaped member, for attaching the nozzle assembly to a user's limb.

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